PROC. ENTOMOL. SOC. WASH.
81(2), 1979, pp. 207–210

DEVELOPMENT AND SURVIVAL OF *MEGASELIA SCALARIS* (DIPTERA: PHORIDAE) AT SELECTED TEMPERATURES AND PHOTOPERIODS

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Abstract.—Newly eclosed *Megaselia scalaris* larvae were placed on commercially available *Drosophila* media to determine developmental time and survival to the adult stage at temperatures of 21°, 27°, and 32°C and at LD:12-12 and LD:16-8. With few exceptions, the developmental time and percentage survival decreased with increasing temperature. Mean developmental time of insects reared at 21°C showed an increase of approximately 300% over those reared at 32°C. The survival fluctuated from a low of 50.0% at 32°C to a high of 82.0% at 21°C. Photoperiod significantly affected development at the lower temperatures.

Megaselia scalaris (Loew.) is a small yellowish-brown phorid of nearly cosmopolitan distribution (Robinson, 1971). Larvae have been reported developing on a wide variety of host materials, including: Decaying meat; decomposing insects; feces from many sources; milk; plant materials; and in one case, boot polish (Patton, 1922; Robinson, 1975). The occurrence and control of this fly in cockroach colonies was reported by Robinson (1975). Adult and immature stages of this species have been adequately described (Grandi, 1914; Patton, 1922; Semenza, 1953; Haider, 1956; Borgmeier, 1964; and Robinson, 1978).

Although *M. scalaris* has been used in genetic studies (Burisch, 1963; Mainx, 1964), and the larvae have been known to cause myiasis in man and animals (Haider 1956), little is known about its basic biology. Because of the potential of this species as a medical problem and pest in insect colonies, this study was undertaken to increase the basic knowledge available on the survival and development of this insect.

Methods and Materials

Megaselia scalaris adults were obtained from laboratory colonies maintained in the Department of Entomology, Virginia Polytechnic Institute and

State University. Approximately 50 adults were allowed to oviposit for 12 hours on commercially available *Drosophila* media and moistened cheesecloth. Eggs were collected from the surface of the media with a double "0" paint brush and placed on moistened filter paper. Eggs laid on cheesecloth were collected by rinsing the cheesecloth in a small beaker of tap water and pouring the water and dislodged eggs through a funnel lined with filter paper. All eggs were sealed in a small plastic container maintained at 27°C. After 24 hours newly eclosed larvae were placed on freshly prepared media in sterile quadrant petri dishes. Two of the four compartments in the petri dishes were left empty to allow the larvae dry surfaces on which to pupariate.

Five replicates of 10 larvae per container were allowed to develop in each of three temperature-photoperiod chambers set for 21°, 26°, and 32°C (±1°C), respectively. Photoperiod was maintained at light-dark (LD):12-12 for all chambers. This test was repeated using the same sample sizes and temperatures in chambers set for a photoperiod of LD:16-8.

Larvae were examined at 12 hour intervals. Newly formed puparia were removed, placed in 25 dram snap cap containers with moistened filter paper and returned to the same chamber from which they had been removed. Puparia were examined at 12 hour intervals; emergence and the sex of the adults were recorded.

Results and Discussion

The survival rate of *M. scalaris* was influenced by both temperature and photoperiod (Table 1). In general, a photoperiod of LD:12-12 permitted a more uniform survival for each temperature than LD:16-8. Although this trend could be seen in development before and after pupariation, survival was obviously more uniform in LD:12-12 when the total developmental time was considered. Statistically, the only significant differences (*t*-test; $P < 0.05$) in mortality between photoperiods occurred at 21°C; the percent survival of: 1) larvae developing until pupariation and 2) insects developing to the adult stage was significantly greater at LD:12-12 than LD:16-8.

With few exceptions, survival increased with decreasing temperature. However, significant differences in survival for the total developmental time were found only in LD:12-12; survival at 32°C was significantly different (Least Significant Range Test, $P < 0.05$) from both 27°C and 21°C.

Because the data on the developmental rates of *M. scalaris* were not normal and could not be completely normalized with transformations, contingency tables measuring differences in frequency of occurrence throughout the ranges were used to statistically compare growth rates. A factorial analysis of variance (attempted for comparative purposes) found the same relationships, with one exception: Photoperiod did not sifnificantly influence development at 27°C.

Table 1. Mean percent survival of *Megaselia scalaris* at selected photoperiods and temperatures.

Developmental Interval	Temperature °C	Photoperiod LD:12-12	Photoperiod LD:16-8
Pre-pupariation	32	64.0 ± 8.9[1]	67.5 ± 12.6
	27	78.0 ± 8.4	80.0 ± 10.0
	21	88.0 ± 8.4	64.0 ± 16.7
Post-pupariation	32	82.8 ± 25.5	72.0 ± 19.6
	27	97.8 ± 4.9	75.0 ± 17.9
	21	93.5 ± 9.3	93.5 ± 9.3
Total development	32	52.0 ± 14.8	50.0 ± 21.6
	27	76.0 ± 5.5	60.0 ± 17.3
	21	82.0 ± 8.4	60.0 ± 18.7

[1] Based on 5 replicates of 10 L each, ±SD; except at 32°C and LD:16-8 which was based on 4 replicates of 10 L each.

Based on contingency table analysis, temperature affected developmental times significantly ($P < 0.05$); the rate of development increasing with increasing temperature (Table 2). Also, growth rates were significantly faster ($P < 0.05$) in LD:12-12 for larvae developing until the onset of pupariation at 21°C. Development was not significantly different between photoperiods at 27°C or 32°C. Analysis of photoperiodic effects on development after pupariation and on the total developmental time found significant differences

Table 2. Range and mean developmental time in days for *Megaselia scalaris* at selected temperatures and photoperiods.[1]

Developmental Interval	Temperature °C	Photoperiod LD:12-12 $\bar{X}$ ± SD	Photoperiod LD:12-12 Range	Photoperiod LD:16-8 $\bar{X}$ ± SD	Photoperiod LD:16-8 Range
Pre-pupariation	32	5.39 ± 1.06	3.75–7.25	6.00 ± 0.88	3.75–7.75
	27	6.85 ± 1.07	5.25–10.25	7.02 ± 0.79	5.75–8.75
	21	16.67 ± 2.87	12.25–21.75	14.92 ± 1.84	11.75–17.75
Post-pupariation	32	7.31 ± 0.36	6.75–7.75	7.33 ± 0.41	6.75–7.75
	27	10.45 ± 1.18	9.25–16.25	10.83 ± 0.60	9.25–11.75
	21	20.14 ± 0.82	17.75–21.25	18.75 ± 0.62	17.75–20.25
Total development	32	13.53 ± 1.09	11.25–15.75	12.99 ± 1.00	11.25–14.75
	27	17.37 ± 0.69	16.25–18.25	18.30 ± 0.92	16.25–20.25
	21	36.95 ± 3.29	31.75–42.75	33.33 ± 2.09	29.25–37.25

[1] Based on at least 26 insects per temperature.

($P < 0.05$) in growth rates between photoperiods at 21°C and 27°C, but not at 32°C.

Acknowledgments

We are grateful for the statistical help provided by Dr. J. W. White and Dr. S. K. Lee of the Statistics Department, VPI & SU, and to Dr. W. H Robinson, Department of Entomology, VPI & SU, for identifying the phorids and reviewing this manuscript.

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